WINDOW WITH GLAZING PROFILE

DESCRIPTION

Technical Field

The present invention relates to a window with a glazing profile, to a glazing for the window, and also to the glazing profile itself. The window may be for a vehicle, and further aspects of the invention relate to methods of glazing a window in a vehicle, and of centring the glazing relative to an aperture in a vehicle body.

Vehicle windows are often glazed by direct bonding, i.e. an adhesive material is used to attach the glazing to the vehicle body. This method allows flush glazing (i.e. the outer surface of the window is flush with the vehicle body) or near-flush glazing, and, as well as improving the product, may reduce assembly costs because it lends itself to automation using robots.

The deployment of robots for this task is greatly facilitated if the glazing self-centres as it is inserted in the aperture. Accurate centring is especially important when the glazing is to be flush glazed without a trim strip covering the gap between the edge of the glazing and the adjacent bodywork, because if the glazing is off-centre, the gap will vary in width around the perimeter of the glazing, which is aesthetically undesirable.

Another consideration is to provide means for retaining the glazing in place while the adhesive material sets. There is obviously little point in obtaining accurate centring of the glazing during its initial insertion in the aperture, if it slips out of position before the adhesive has set.

A further consideration is that the window should appear aesthetically acceptable from the inside of the vehicle as well as the outside. To this end separate trim strips have been used to cover the mounting flange of the vehicle body, but assembly costs could be further reduced

if the glazing profile could also perform this trimming function.

Background Art

It is known from EP 345 134 and EP 545 896 to provide a glazing with two adhesion beads which harden in different periods of time. One of these beads may include a sealing lip which extends beyond the periphery of the glazing and seals the gap between the glazing and the adjacent vehicle bodywork. This lip may also act as a centring lip when positioning the glazing in the rebate of a window frame.

A problem with these designs is that the distance which the lip may extend beyond the periphery of the glazing is limited by the tendency of the freshly extruded lip to sag and lose its shape before the polymer material of which the lip is composed has set.

US 5,384,995 seeks to address this problem by providing the lip with a supporting release film in contact with each face of the lip. Once the polymer has set, the films are removed by pulling them off the lip. However, the use of such films adds to the cost and complexity of manufacture of the glazing.

Furthermore, all these centring lips suffer from the disadvantage that they are exposed in service to the effects of weathering, in particular UV radiation present in sunlight. This causes deterioration of the polymer material well before the normal service life of the vehicle has elapsed, leading to formation of a black residue, resulting in a generally unattractive appearance. Unfortunately, those polymer materials which resist weathering better are also harder to process during the initial manufacture of the window.

These centring lips are also vulnerable to damage before and during installation of the glazing, and do not allow the "trimless" glazing techniques preferred by some vehicle manufacturers, in which no trim profile is visible between the glazing and the adjacent bodywork.

Moreover, they are not capable of retaining the glazing in position while the adhesive sets, or of covering part of the mounting flange from internal view.

Different embodiments of spacer are also disclosed in Figs 3 and 4 of US 5,384,995 which do immobilize the glazing while the adhesive material sets. However, these embodiments do not centre the glazing, and as centring is becoming increasingly required, recourse to one of the known centring lips would be necessary to fulfil the centring requirement, which would then entail the disadvantages associated therewith.

There is therefore a need for a glazing profile, capable of centring a glazing, which is protected from weathering and from accidental damage and is relatively cheap and easy to manufacture. Preferably the profile should allow trimless glazing if desired, and it should also retain the glazing in position while any adhesive material sets.

There is also a need for a glazing profile which can also serve as part of the internal trim of the vehicle. Again, it would be preferable if the profile were able to perform this function in combination with the centring and retaining functions mentioned above.

Disclosure of the Invention

It has now been found that it is possible to provide a window with such a profile. By designing the profile to act on the inner edge of a mounting flange, instead of on a distance portion of the flange which spaces the parallel portion of the flange from the outside surface of the vehicle body, it has become possible to provide a glazing profile including a functional element which not only centres the glazing, but can, if desired, perform retaining and trimming functions as well or instead, and which does not suffer from the disadvantages of the prior art.

According to the present invention there is provided a window for a vehicle, comprising a glazing including an

elastomeric glazing profile disposed around at least part of its periphery on a margin of a face of the glazing, and a mounting flange having an inner edge defining an aperture in a vehicle body, the glazing being inserted in the aperture from outside the vehicle body, characterised in that the profile includes a raised portion shaped and positioned to centre the glazing within the aperture during insertion in the aperture by bearing against the inner edge of the mounting flange, and the glazing is bonded to the mounting flange by an adhesive material.

This window has the advantage that the centring element of the profile is not exposed to the weather or to UV radiation. Indeed, in many embodiments of the invention, the whole profile is protected from these harmful agents. The functional element of the profile is also better protected from accidental damage, allows trimless glazing if desired and may be adapted to perform additional functions as described below.

The term "inner" is intended here to mean "towards the centre of the aperture", and "edge" is to be interpreted as including any narrow face in which the mounting flange terminates as well as a meeting-line of such a face with one of the major faces of the mounting flange.

Preferably, the profile includes a raised portion in the form of a lip extending away from the glazing which, after insertion of the glazing in the aperture, extends beyond the edge of the mounting flange of the vehicle body and over the face of the mounting flange which faces away from the glazing.

The glazing profile of this version of the window may eliminate the need for a separate piece of interior trim, thereby simplifying the assembly of the vehicle and reducing the manufacturing costs of the vehicle, while improving the aesthetics of the passenger compartment.

Preferably the glazing profile further includes a spacer portion on the peripheral side of the raised

portion, the spacer portion abutting against the mounting flange during installation thereby acting as a stop for the glazing and maintaining the glazing in fixed spaced relationship to the mounting flange. Such a spacer portion ensures that the window may be accurately glazed flush with the surrounding bodywork.

Preferably the raised portion of the glazing profile is adapted to retain the glazing in a centred position while the adhesive used to bond the glazing sets. The need for separate clips, clamps or other supports is thereby eliminated.

According to another aspect of the invention, there is provided a method of glazing a window in a vehicle, including:

providing a glazing including an elastomeric glazing profile disposed on a margin of a face of the glazing around at least part of its periphery, and a mounting flange having an inner edge defining an aperture in a vehicle body,

applying a bead of adhesive material to the glazing or the mounting flange,

offering the glazing to the aperture from outside the vehicle body, including

centring the glazing relative to the aperture as it is inserted,

characterised by centring the glazing by means of a raised portion of the glazing profile shaped and positioned to bear against the inner edge of the mounting flange.

According to a further aspect, the invention also provides a method of centring a glazing relative to an aperture in a vehicle body as herein described, regardless of the means employed to attach the glazing to the vehicle body.

The invention will now be illustrated by the following description of preferred non-limiting embodiments with reference to the accompanying drawings (all being cross-sections taken in a plane perpendicular to the periphery of the window) in which like reference numerals denote like elements, and:

Fig 1 shows part of a window according to a first embodiment of the invention;

Fig 2 similarly shows part of a window according to a second embodiment of the invention;

Fig 3 corresponds to Fig 1, and shows the glazing of Fig 1 during insertion into the aperture, and before reaching its final position;

Fig 4 shows part of a window according to a third embodiment of the invention;

Fig 5 corresponds to Fig 4, and shows the glazing during insertion into the aperture;

Fig 6 shows a fourth embodiment of the invention;

Fig 7 corresponds to Fig 6, again showing the glazing during insertion.

Fig 8 shows a fifth embodiment of the invention; and

Fig 9 corresponds to Fig 8, showing the glazing during insertion.

Referring to Fig 1, a first embodiment of part of a window according to the invention is shown in cross section. The window comprises a glazing 10 and a mounting flange 5, which is part of the bodywork 3 of a vehicle; the glazing 10 itself including a pane of glazing material 1 and a glazing profile or seal element 11. The pane of glazing material may be composed of any material suitable for a vehicle glazing, e.g. glass or plastics material, and if composed of glass it may be toughened or laminated, bent or flat, and of clear, tinted or coated glass.

The glazing profile 11 may likewise be composed of any suitable polymer e.g. polyurethane, pvc, pvc in plastisol form, or thermoplastic elastomers and may be

manufactured by extrusion or a moulding process, e. g. injection or flow-moulding, as appropriate. In the embodiments of the invention herein described, the glazing is attached to the vehicle body by means of an adhesive material 4.

The mounting flange 5 comprises a parallel portion 6 which is substantially parallel to both the external bodywork 7 and the pane of glazing material 1 where they meet. The parallel portion of the mounting flange 5 ends at an extreme inner edge 8 which defines an aperture in the vehicle body. Between the parallel portion 6 and the external bodywork 7 is a distance portion 9 which spaces the parallel portion from the external bodywork 7. The mounting flange has two faces 18 and 19; face 18 faces the glazing whereas face 19 faces away from it.

The glazing normally also includes an obscuration band 2, comprising an opaque layer e.g. of ceramic ink, which serves both to obscure the glazing profile, adhesive and mounting flange from external view thereby improving the aesthetic appearance of the vehicle, and to protect those elements from the effect of sunlight, especially the ultra-violet component. It is an advantage of the present invention that, if desired, the whole glazing profile may be obscured from view and protected from weathering (including the effect of UV radiation) by the pane of glazing material and especially by the obscuration band.

The glazing profile comprises at its simplest a bed portion 13 and a raised portion, which in this embodiment is in the form of a curled lip 12. Preferably there is also a spacer portion 14 on the peripheral side of the raised portion, i.e. on the side towards the periphery of the glazing. During insertion of the glazing, the spacer portion 14 will come to abut onto face 18 of the parallel

portion 6 of the mounting flange 5, thereby acting as a stop for the glazing and maintaining it in fixed spaced relationship to the mounting flange.

Generally the spacer 14 will be of uniform thickness around the glazing to maintain the glazing 10 at a uniform spacing from the mounting flange 5. However, should the depth of the distance portion 9 of the mounting flange vary around the aperture, the thickness of the spacer portion and raised position can also be raised to compensate. Clearly, if the glazing is to be glazed flush with the external bodywork, the combined thickness of the pane 1 and the spacer portion 14 should be approximately equal to the depth of the distance portion 9.

The adhesive material 4 employed is generally sufficiently viscous to remain substantially in position after application; however, if the need arises (e.g. if an adhesive material of unusually low viscosity is to be used), the spacer portion 14 may be dimensioned and positioned so that it acts as a dam which constrains the spreading of the adhesive material. The same applies to other spacer portions mentioned hereinafter.

As was mentioned above, in this embodiment, the raised portion of the profile 11 is in the form of a curled lip 12 having a base 15 which extends away from the glazing, the remainder of the lip (comprising the body 16 and the tip 17 of the lip) then curling over towards the mounting flange 5 in the form of a scroll. When suitably proportioned, this shape of raised portion is capable of centring the glazing during insertion, retaining the glazing in position while the adhesive sets (both of which will be explained in more detail in connection with Fig 3 below), and covering the edge 8 of the mounting flange, thereby eliminating the need for a separate trim strip on this edge.

Optionally, the space defined by the lip curling over may be utilised for an auxiliary component, for

example, one or more electrical wires or leads 103 may be housed within this space. Such leads may be used to provide electric power to electric equipment on or adjacent the window, such as a heating element disposed on the window, or a window wiper. Safety legislation in some countries now requires a further brake lamp to be provided, mounted on the rear window, and the wiring for such brake lamps may conveniently be concealed within the curl of the lip 12. Alternatively the lead(s) 103 may be used to carry the signal from an antenna mounted on or near the window. Although these leads are only shown in Fig 1, they can of course be included in any of the embodiments of the invention.

After installation of the glazing, a small and uniform gap denoted by arrow Z may remain between the pane 1 and the bodywork 3. If trimless glazing is preferred this gap may be left as it is, or alternatively it may be filled by a separate finishing trim strip 100 to avoid dirt and moisture collecting in the gap, albeit with some loss of flushness. The use of a finishing trim strip is especially preferred when the pane 1 is of laminated glass. Alternatively, the second embodiment may be employed, as will now be described.

Fig 2 shows a second embodiment of the invention, which in many respects is the same as the first embodiment, but in which the glazing 20 includes a modified glazing profile 21. The modified profile includes a "drooping" sealing lip 28, i.e. a short lip on the peripheral side of the profile, which initially extends outwards from the glazing 20, but curves round towards a direction perpendicular to the faces of the glazing. This lip 28 does not centre the glazing during insertion, but merely comes to rest against the vehicle bodywork to seal against ingress of dirt and moisture in a similar way to finishing strip 100.

Preferably the profile 21 also includes a second spacer portion 24 to which the sealing lip 28 is

attached. The curled lip 22, bed portion 23 and spacer portion 24 are equivalent to the corresponding portions of the first embodiment.

Fig 3 shows the glazing 10 of the first embodiment at an intermediate point during insertion into an aperture in a vehicle body. The glazing has yet to move further in the direction of arrow X to reach its final position. The following description of the installation of the glazing is also equally applicable to the second and third embodiments, as it is not affected by the presence or absence of sealing lip 28 and spacer 29.

A bead of adhesive material 4 having been applied to the glazing 10 on the peripheral side of the profile 11, the glazing is offered to the aperture. Outer surface 101 of the curled lip 12 is shaped and positioned so as to make contact with the inner edge 8 of the mounting flange 5; if the glazing is presented off-centre to the aperture, the surface 101 of the curled lip will first contact the inner edge 8 in just one particular location, rather than along the entire length of the lip simultaneously. The lip will bear against the inner edge in this location, and so the glazing will be correspondingly urged away from this location until the lip contacts the edge around the entire length of the lip. When the curled lip is elastically deformed to an equal extent around its entire length by pressure against the edge, the glazing will be centred. The glazing is inserted until the spacer portion 14 (if employed) abuts against the mounting flange, or the glazing is deemed to have been inserted sufficiently far by other means.

Next, the lip 12 is lifted and pulled over edge 8 so that the tip 17 bears against face 19 of the mounting flange as shown in Fig 1. This may be accomplished manually or with a suitable means of pulling the lip over the edge of the flange. A preferred way is to provide a cord 102 within the curled lip 12 (i.e. within the space defined by the curl of the lip); the cord is hooked out

locally at a convenient place and pulled in the direction of arrow Y (Fig 3). As the cord escapes from the curled lip, it progressively pulls the lip into its final position. Alternatively an elastic metal wire may be provided within the curled lip and used in the same way. The degree to which the lip is lifted during this operation increases from its base to its tip. When electrical leads are housed in the curl of the lip, they should be placed further into the curl, away from the tip 17 of the lip, than the pulling means, so that the pulling means does not accidentally pull the electrical leads out of the curl in the course of pulling the lip over the flange.

Another preferred way is to provide a pulling means as an integral but detachable part of the glazing profile. Figs 4 and 5 show a third embodiment of the invention which is provided with such a pulling means, Fig 5 again showing the glazing at an intermediate point during insertion. The glazing 30 of Figs 4 and 5 includes a profile 31 which is modified by joining a bead 39 to the tip 37 of the curled lip 32 by means of a narrow neck portion 38. The thickness of the neck portion is selected to be strong enough to transmit a sufficient pulling force to the lip to pull it over the edge 8 of the flange 5, but weak enough for the elastomeric material to tear at the neck portion once the lip has been pulled over the mounting flange, thereby causing the bead 39 to detach from the lip. The bead may be pulled manually or with a suitable tool, and the direction of the pulling force is again shown by arrow Y.

Once the glazing is in its final position, the tip 17 of the curled lip 12 exerts a force on the mounting flange as a result of the elastic properties of the lip which is somewhat stretched from its relaxed configuration when in its final position over the flange. This force retains the glazing in place while the adhesive material 4 sets, and indeed retains the lip

itself in place over its service life, during which it may act as part of the internal trim of the vehicle as mentioned elsewhere.

Figs 6 and 7 show a fourth embodiment of the invention in which the curled lip and sealing lip of the second embodiment have been united by extending the bed of the glazing profile so that the profile comprises a single piece of the same elastomeric material. As before, Fig 7 shows the glazing 40 at an intermediate point during its insertion into the aperture. The modified profile 41 is made up as follows: a first tongue or sealing lip 48 which initially protrudes in a direction essentially parallel to the surface of the pane of glazing material; a raised portion in the form of a second tongue or lip 42 which, starting from the opposite edge of the profile to the sealing lip, initially protrudes at its base (or root) 45 in a direction essentially perpendicular to the pane 1, the lip again taking on the shape of a curl elastically curving over itself, thereby forming a curled lip 42.

The glazing profile 41 also includes a slot or channel A, into which the adhesive material 4 is applied to allow adhesion to the bodywork 3; said channel is bordered by two beads A' and A", with a height of a' and a", respectively, in which the ratio between a' and a" is always greater than one. Both beads act as spacer portions, but it is the height a" of bead A" which is finally determinative of the spacing of the glazing from the parallel portion 6 of the mounting flange 5.

The difference in height between A' and A" is equalised when the profile 41 is glued to the bodywork, thanks to the pressure exerted on the higher element A' by the flange 5 of the bodywork 3. In an alternative version of this embodiment, when containment of the adhesive material 4 is less critical, the bead A' may be omitted.

The trim function is achieved when the bodywork 3 and the glazing profile make contact with each other in the area of the channel A by means of the two beads A' and A", that is to say when the glass is glued onto the bodywork 3, by means of the adhesive 4, as shown in Fig 6.

The curled lip 42 is then lifted and progressively pulled over the flange due to the effect of traction by elastic metal elements housed inside the curl, until the lip rests on the face 19 of the flange, exerting on said face a pressure sufficient to retain the glazing in position and seal against the flange. For preference, the elastic metal elements are elastic metal wires as shown in Fig 3.

With the aim of allowing the necessary elasticity of the lip 42, which must be sufficiently elastic for the tip 47 to rest on the bodywork flange 5 and to exert the desired pressure thereon, but must not exert an elastic return force high enough to roll up upon itself, thus compromising its performance, it has been found that the thickness of the lip 42 must decrease gradually from base to tip so that the section shows three different thicknesses, which are defined as follows:

b1 = thickness at the base or root 45 of the lip,

b2 = thickness in the body 46 of the lip, halfway between the base and the tip,

b3 = thickness at the tip 47 of the lip.

The relationship between the different thicknesses is that:

b1 > b2 > b3, where the ratio between b2 and b3 is always greater than 1.2 and the ratio between b1 and b2 is preferably greater than 1.5.

The overall dimensions of the glazing profile, including the width W which is bonded to the pane of glazing material, are dependent upon various parameters such as the size of the glazing, the strength of the bonds to the pane and to the mounting flange etc.

Figs 8 and 9 show a fifth embodiment of the invention, and as before, the first figure (Fig 8) shows part of the window after installation of the glazing 50 has been completed, whereas the second figure (Fig 9) shows part of the window with the glazing at an intermediate point during its insertion into the aperture. In this embodiment the raised portion 52 of the glazing profile 51 is no longer in the form of a curled lip. Instead it may be of generally wedge-shaped or bulbous form, and it is characterised by the configuration of the peripheral side of the raised portion, i.e. the side adjacent the mounting flange 5.

This side is configured with a first slanting surface 55 which is at a first slanting angle to the mounting flange, and a second slanting surface 56 at a second slanting angle to the mounting flange. The surfaces may be planar, multi-planar or curved, and so the angle of slant to the mounting flange may vary across each surface. Preferably, the slanting angles θ_1 and θ_2 between each slanting surface and the major face of the pane are in the range 10° to 80°, more preferably 20° to 70°. The two surfaces are separated by a step 57 which forms an apex 58 with the first surface 55. The dimensions of the glazing profile are chosen so that the circumference of the profile measured along the apex 58 of the step 57 is somewhat greater than the circumference of the aperture measured along inner edge 8. As will become evident from the following description, it is desirable for the raised portion 52 to be flexible, and if its width is such that the inherent flexibility conferred by the elastomeric material of which it is composed is insufficient, a groove 59 may optionally be provided. The groove 59 extends around the profile in a direction generally parallel to the glazing on an inner face of the profile. The groove 59 may also be used for the location of an internal trim member if desired, and/or electrical leads may be housed within it. Preferably a spacer portion 54

is provided as previously described in connection with the first embodiment, thereby ensuring accurate and positive spacing of the glazing from the mounting flange. In a variation of the present embodiment, the spacer portion 54 and the raised portion 52 may be united by a bed portion extending between them, as in the fourth embodiment (Figs 6 and 7).

During insertion of the glazing 50 into the aperture, the first surface 55 contacts and bears against inner edge 8 of the mounting flange 5 as shown in Fig 9. As additional pressure is exerted to urge the glazing further into the aperture in the direction of arrow V, the raised portion 52 is elastically deformed, bending towards the centre of the aperture to allow the apex of the step to slip past the inner edge 8. The net effect of the forces resulting from the angled first surface acting on the inner edge under the externally applied pressure produces an inward force which centres the glazing if it is presented to the aperture off-centre.

Once the glazing is fully inserted, as shown in Fig 8, the step 57 and the second surface 56 combine to maintain the centred position of the glazing. Furthermore, the step prevents the glazing from slipping out of the aperture before the adhesive material 4 has set; when used in conjunction with spacer 54, the glazing is retained especially securely in position in all three dimensions.